For and by Student Dashboards Design to Address Dropout

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ABSTRACT: This paper focuses on the design process of a student dashboard, in the frame of a Learning Analytics project. The dashboard is intended to reduce dropout of first-year University students. The strong points of this dashboard are three-fold: 1) the involvement of students in the whole design process, 2) the possibility of students to personalize the dashboard, 3) the possibility of indicating personalized goals.

Keywords: Student dashboard, student dropout, higher education.

1 INTRODUCTION

The French project EOLE (Engagement to Open Education - http://www.dune-eole.fr) aims at designing a different approach of education at the University, both in its modalities and in the enlargement of its target audience. This major challenge is fundamental to develop the contribution of universities in the learning sector, in both a citizen and a competitive approach. One of the numerous goals in EOLE is to address students' dropout problem, mainly for first-year students, who are known to massively dropout.

Two achieve this goal, EOLE relies on two main hypotheses: 1) most of the students who dropout lack information about their learning behaviour: the way they learn, compared to others or not, about their progress related to the expected output, etc. So, if students can get more information, dropout will decrease; and 2) if students can feel under control of their learning process or feel heard, by informing their expectations, receiving advice, etc., dropout will also decrease.

Based on these hypotheses, EOLE proposes students to access course-level personalised dashboards. To ensure a high quality dashboard, a multi-profile team has been set up: teachers, students, vice-rectors, computer scientists, researchers, among others. For the sake of representativeness, teachers and students from a great diversity of disciplines are involved in the team. This multi-profile team and the involvement of students in all steps of the project are one strong point of this project.

The dashboard, and the associated features and indicators, are further presented and explained below. A study of the impact of the dashboard on student dropout will be conducted in the following weeks.

2 RELATED WORKS

In the literature, self-regulated learning (SRL) can be defined as being "an active, constructive process, where learners define their learning objectives and try to supervise, regulate and control their cognition, motivation behaviours, guided and constrained by their objectives and characteristics related to the environment" (Pintrich, 2000). Zimmerman (Zimmerman, 2002), also explains that the differences in learning success are mostly attributed to the self-regulation ability of learning, which are relevant to the initiation and maintenance of the learning process. In addition, a recent study by Aljohani (Aljohani et al., 2019) shows that student-centred dashboards (Govaerts et al., 2012, Odriozola et al., 2012) increase student engagement (investment in time, etc.) more than teacher-centred dashboards (Guo et al., 2017) (in the latter case student engagement could be increased through the interaction between students and teachers). In this latter study, students can consult a dashboard giving them statistical, graphical and textual feedback about their learning. The use of this dashboard by students has been tracked and an analysis shows that students who use the dashboard are significantly more engaged (i.e. spend more time on the platform and have more activities on the forums).

3 BUILDING A STUDENT-CENTERED DASHBOARD

As highlighted in the literature, dashboards are a way to support students in the self-regulation of their learning. EOLE assumes that it can also be a way to address student dropout, and thus proposes to design a dashboard that is targeting students. The key point in this design is that students are at its core.

In a preliminary phase, students have been invited to share their needs, in terms of features/functionalities of a dashboard. A needs analysis has been conducted with about 100 first-year students. Below are the most recurrent needs that students expressed. Notice that some of them have been highlighted in a similar study (Schumacher & Ifenthaler, 2018).

- Indicators should be sufficiently diversified so that every student can find those corresponding to his/her wishes.
- Obsession with indicators should be avoided.
- Indicators must be beneficial and their reading must be easy.
- Indicators should value the advice between peers. Senior students should volunteer to mentor junior students.
- Advice about the methodology of academic work (organization, work methods) is welcome, not just help about course content.

This needs analysis resulted in the design of a first prototype of the student dashboard. It has then been presented to other first-year students to obtain their feedback about the features and the indicators proposed. In all, more than 300 first-year students, spread over several iterations, gave their opinion during the iterative and incremental co-design of the dashboard.

A strong assumption on which EOLE relies is that a dashboard is a tool that should be made for the students' own interest, and that it should not be intended to constrain students. To ensure that, at each iteration of the dashboard design, students' opinions were collected through a questionnaire. The first version of the dashboard (from the first iteration) was presented to 88 students, along with questions about the features they think they would use if these features were made available to them. The results of this questionnaire are presented in Table 1. Although the literature highlights the comparison with peers, especially in higher education, only 56% of the students are in favour of this feature, i.e. nearly half of the students do not wish to compare themselves with their classmates. In addition, 5 students (6%) expressed their fears and apprehensions about the impact of comparing themselves with peers on their personal well-being. It has thus been decided to display the peer comparison feature only on demand of the student. Thus, students who want this feature have to explicitly tick the appropriate answer. Other less requested features were not explicitly criticized by students, so it has been decided to keep them on the dashboard.

Table 1: What feature students wishes in a dashboard?

Feature	Percentage of students who would use the feature (out of 88)
Individual performance	99%
Peers comparison	56%
Automatic advice	52%
Help other students	48%
Ask for advice	38%

The final version of the dashboard (presented in Figure 1) has been obtained after three iterations. The dashboard displays indicators about the activity of a specific student in his/her Algorithms and programming course. It is divided into two parts. This final version is available at the following link. Since this is an interactive and customizable dashboard, the best way to understand it is to interact with it directly online.

3.1 "My activity" part of the dashboard

The left part of the dashboard, named "My activity" (Figure 1) displays raw indicators of the student's activity. This part includes the most awaited functionality by the students: the individual performance (99% of students have declared to want it). Three types of raw indicators have been selected:

- Activity indicators (blue ones): number of submitted works, quiz scores, number of resources viewed and the total number of actions on the course.
- Student engagement indicators (red ones): number of active days, weekly regularity and number of completed automatic advice. The weekly regularity of a student has been adapted from (Boroujeni, Sharma, Kidziński, Lucignano, & Dillenbourg, 2016), which shows not only that students easily understand the meaning of this indicator but also that they are interested in discovering if they are working less than in

previous weeks. A correlation of 0.28 is observed between the weekly regularity that we have adapted and the course score. This correlation is calculated from the students' traces of activity enrolled in the course during the previous years and the final results of the students. With a *p*-value of 0.002, we can conclude that there is a significant link between the weekly regularity of student work and their academic performance.

- Collaboration indicators (green ones): number of created topics on the forum, number of answers, number of times the student asked for help.

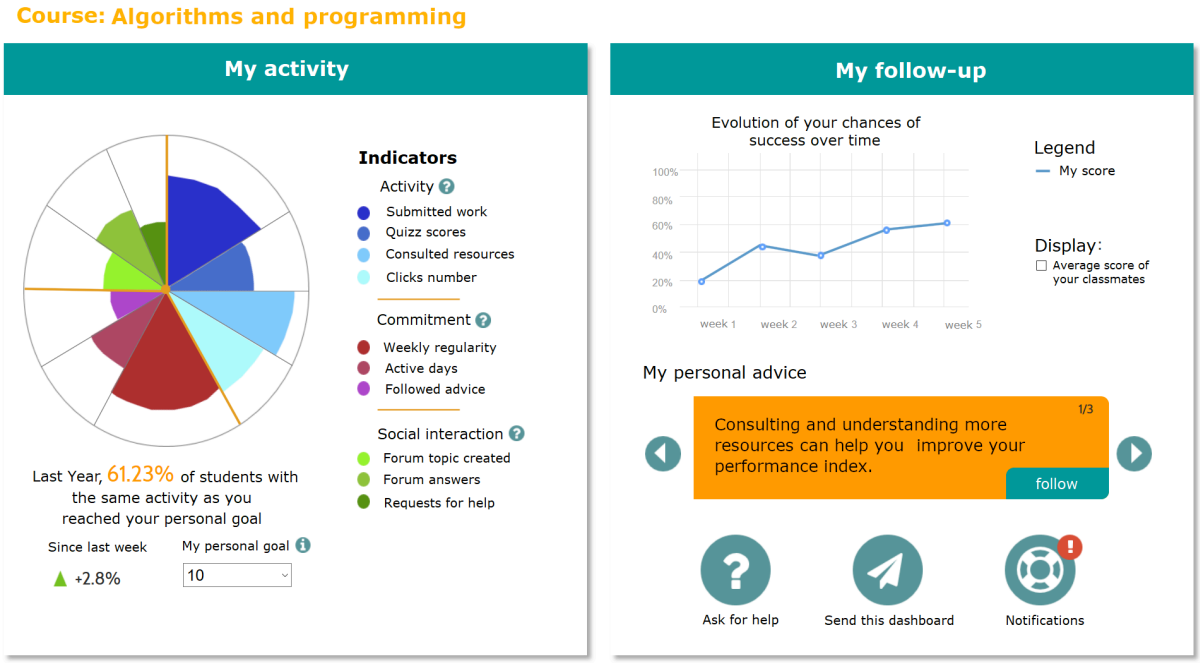

Figure 1: Final version of the dashboard

Besides, during the co-design iterations, most of the students have put forward the fact that learning traces collected by the system only represent a partial view of their activity. Based on this feedback, it has been decided to add an edit function to allow students to modify the indicators displayed on the dashboard. Thus, these user-modified indicators should better reflect students' actual learning activity. More importantly, students stay in control of their personalised dashboard.

Last, an additional indicator requested by students and proposed in this dashboard, is the student's overall performance (lower section of the left part). To make this indicator possible, students are proposed to provide, on the dashboard, the score that they would appreciate to achieve on the final exam (the personal goal). In Figure 1, the expected score given by the student is 10 (out of 20). In this case, the associated overall performance indicator is 61.23%. This indicator is evaluated as the odds percentage that a student achieves his/her personal goal. As students directly set their personal goal, the student's overall performance is directly influenced. Let two students have the same value on two indicators, the one who foxed his/her personal goal to 18 will not have the same odds percentage as a student who fixed his/her personal goal to 10.

Many indicators that are proposed in the dashboard, such as the indicator of future success, which depends on students' personal goal, but also the fact that students can modify the content of the indicators, have not only been designed to increase the information students can access, but also to increase their feeling of being heard and understood. The expected effect is a decrease of student dropout, especially for students who may lack of confidence in themselves.

3.2 "My follow-up" part of the dashboard

The right part of the dashboard (Figure 1) is divided into three elements.

- At the top, the evolution of the student's performance over time is displayed, in the form of a line chart. This is where the student can choose to display the average performance of his/her classmates.
- In the middle of this part, personalized advice is provided to the student to help him/her improve his/her performance (orange rectangle). The student can follow or not the advice, depending on his/her goodwill.
- At the bottom, two action buttons allow the student to ask for help. The first one is dedicated to receiving help from the teacher. By clicking on this button, the student also accepts to share the data displayed in his/her dashboard. The second one, labelled "send this dashboard", only shares a capture at time *t* of the dashboard. The last button is a notification queue to manage the actions of the first two buttons.

The highly personalisable side of this dashboard is intended to make students feel understood and may access the dashboard more often, which could reduce dropout, as students may feel less isolated.

4 USABILITY

The usability of the dashboard proposed here has been evaluated with the System Usability Scale (SUS) (Bangor, Kortum, & Miller, 2008). Although this scale does not allow to strictly quantify the usability, the score obtained (between 0 and 100) allows to locate the perceived usability of the dashboard by the student. 127 students took this well-known test of the user experience literature. The results obtained are presented in Figure 2.

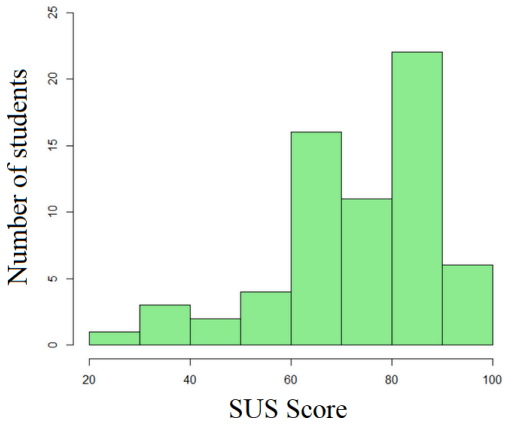

Figure 2: SUS results repartition

We observe the 1st quartile at 65, the median at 75 and the third quartile at 85. The average score given is 74.12, the minimum 27.5 and the maximum 100. In UX Design methods (Lallemand & Gronier, 2015), the authors propose an interpretation scale of the SUS score. Figure 3 presents the associated interpretation scale.

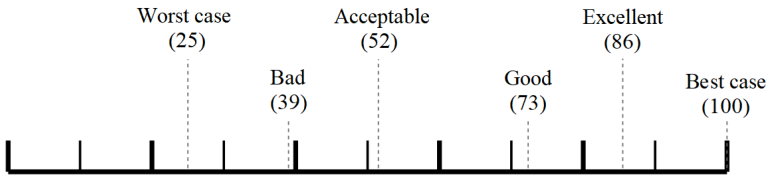

Figure 3: Interpretation scale of SUS score

With an average score of 74.12, the dashboard proposed is between "Good" (73) and Excellent (86), which is rather promising for our imminent 1st live study.

5 CONCLUSION

The work presented in this paper focuses on a student dashboard design process, adopted by the team of the EOLE project. This dashboard is aimed, among others, to decrease student dropout. Its design involves a multi-profile team, including students, who are the recipients of the dashboard. The futher step is the test of this dashboard and its actual impact on dropout.

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